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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/076,630	02/19/2002	Chia-Chi Chung	8409.0004-00	2599

7590 08/26/2003

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EXAMINER

LEE, CALVIN

ART UNIT PAPER NUMBER

2825

DATE MAILED: 08/26/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/076,630

Applicant(s)

CHUNG ET AL.

Examiner

Lee Calvin

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 July 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

FINAL ACTION

Response to Amendment

1. The amendment of claim 1, filed on July 29, 2003, is acknowledged.

Claim Rejections - 35 U.S.C. § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-4, 6-9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Wu* (US 6,511,916) in view of *Tu et al.* (US 6,147,005).

Wu discloses a method for improving alignment in dual damascene, comprising the steps:

- defining and patterning a first photoresist **440** formed over an insulating layer **410-430**
- etching the insulating material to form a groove **460** [Fig. 4B and col. 4, ln. 31]
- removing the first photoresist [Fig. 4C and col. 4, ln. 31]
- defining and patterning a second photoresist **470** formed over the insulating layer [col. 4, ln. 50]
- depositing a polymer layer over the tops and sidewalls of the second photoresist [col. 4, ln. 61]
- etching the insulating layer to form an opening **460** aligned with the groove **490** [Figs. 4D-4E]
- filling the opening with metal to conventionally form/finish a via [col. 1, ln. 34]

Wu inherently teaches depositing a layer of carbon-fluoride material because a carbon-fluoride material is found in a polymer that is layer 480 in *Wu* reference. Nevertheless, such polymer layer of carbon-fluoride material is notoriously well-known in the semiconductor processing art as evidenced by *Tu et al* teaching a polymer comprised of both carbon and fluoride materials "the polymer layer 24...be formed by...adjusting the etching recipe...by increasing the fluorine atoms...much more polymer layer is formed...by increasing the carbon atoms". *Tu et al* also discloses to deposit a polymer layer **24** over the tops and sidewalls of a photoresist **22** [Fig. 4a], wherein the polymer layer is formed through a PECVD process [col.4, ln.55] at about 20°C (meets claims 2, 4, 7, and 9).

b) Moreover, *Tu et al* discloses to obtain the ratio of carbon to fluorine by using/adjusting according to preferred etching rate and efficient [col. 4, lns.36-56], but not explicitly as the ratio of carbon to fluorine in the carbon-fluoride material being at least 0.25 (meets claims 3 and 8).

It would have been obvious to one having ordinary skill to have modified the carbon-fluorine layer formation of *Tu et al* by utilizing the claimed ratio because one would adjust atoms amount of carbon and/or fluorine to result the claimed carbon-fluorine ratio of 0.25.

a) *Wu* suggests dry etching but not anisotropically etching the insulating layer. *Tu et al.* discloses anisotropically etching an insulating layer 4 to create an opening 27 [Fig. 6B and col 5]

It would have been obvious to one having ordinary skill in the art to have modified the etching process of *Wu* by utilizing the claimed etching because such anisotropically etching technique is notoriously well known in the art to remove a semiconductor layer.

4. Claims 5 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Wu* and *Tu et al*, as applied to claims 1 and 6, in view of *Lin et al.* (US 6,376,366).

The combination of *Wu* and *Tu et al.* does not teach or suggest a defined and patterned photoresist is misaligned with a groove. *Lin et al.* discloses a defined and patterned photoresist 260 is misaligned with a groove 255 formed inside an insulating layer 240 [Fig. 2d and col. 5].

It would have been obvious to one having ordinary skill to have modified the method of *Wu* and *Tu et al.* by utilizing the misaligned process in dual damascene because it simplifies dual damascene process in sub-micron technologies.

Response to Arguments

5. Applicants' argument that "*Wu* does not describe a method for improving misalignment of photoresist" is persuasive. However, the removal of photoresist and polymer residual, taught by *Wu*, eventually will benefit the improvement of photoresist misalignment [col. 1, "the best method of the interconnect process ... the trench profile deformation"].

Admittedly, *Wu* is silent about a carbon-fluoride material. In fact, a polymer comprises both carbon and fluoride materials. It is understood that a polymer is a carbon-fluoride material.

Applicants also argued that *Tu et al* fails to cure the stated deficiencies of *Wu*. Examiner notes that *Wu* teaches the invention features except for the teachings of anisotropical etching. So *Wu* in view of *Tu et al* obviates the deficiency of etching in *Wu*.

Applicants do not claim the insulating layer as a single layer. Therefore, the examiner does consider *Wu*'s first and second dielectric layers as corresponding to the claimed insulating layer.

Please note also in the rejection above, that the specific portions of *Wu* in view of *Tu et al*, relied upon by the Examiner to reject the pending claims 1-11, have been pointed out.

In conclusion, Applicant's arguments are moot in light of a final rejection.

6. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire three months from the mailing date of this action. In the event a first reply is filed within two months of the mailing date of this final action and the advisory action is not mailed until after the end of the three-month shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than six months from the date of this final action.

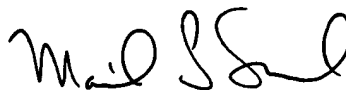
Contact Information

7. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at 703-306-5854, Monday to Thursday, from 7 to 5 (ET). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* whose telephone number is 703-308-1323

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The fax phones are (703) 872-9318 for regular communications and (703) 872-9319 for After-Final communications.

CL

August 21, 2003



MATTHEW SMITH
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